SFOMC Multiplexers Upgrade, Repair, and Integration

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LONG-TERM GOAL

The long-term goal is to support short and long duration testing of shallow water and very shallow water AUV systems and components.

OBJECTIVES

The objective is to provide a versatile, robust, reliable, and maintainable sea floor system of multiplexers and sea floor cables capable of high bandwidth data transmission to shore.

APPROACH

The approach was to build on to existing infrastructure and systems and to reallocate responsibilities and authorities for those systems to better utilize capabilities. Additionally, new systems were designed, constructed, and implemented.

NSWC-SFTF accepted responsibility for the maintenance, repair and operation of the FAU multiplexer. Towards this end NSWC formed a technical working group comprised of NSWC and FAU engineers and technicians. The team made the following recommendations; (1) to harden the system for extended deployment, (2) to make the system more robust and useable, (3) to write a complete operations manual with a clearly defined user interface, and (4) to improve the diagnostics capability. They also recommended that “Smart” dummy plugs be constructed allowing in water testing of each user port prior to plugging into the system.

WORK COMPLETED

SFTF accepted custody of the FAU Multiplexer as part of the FY 02 SFOMC proposal. As part of the transition, SFTF and FAU worked closely in refurbishing the Mux electronics, adding redundancy and robustness to the system, and implementing several new features to improve operations. The entire system is now documented and a complete drawing package is complete. A users manual has also been developed.

The main addition to the Mux system was the development of ten smart plug modules, which are used to test the user ports on the Mux while deployed. Since the Mux user ports are capable of communicating using Ethernet, Lonworks, and serial (RS-232 and RS-422) protocols, a means of testing the ports with an intelligent device was required. The smart plugs consist of a small housing

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The long-term goal is to support short and long duration testing of shallow water and very shallow water AUV systems and components.

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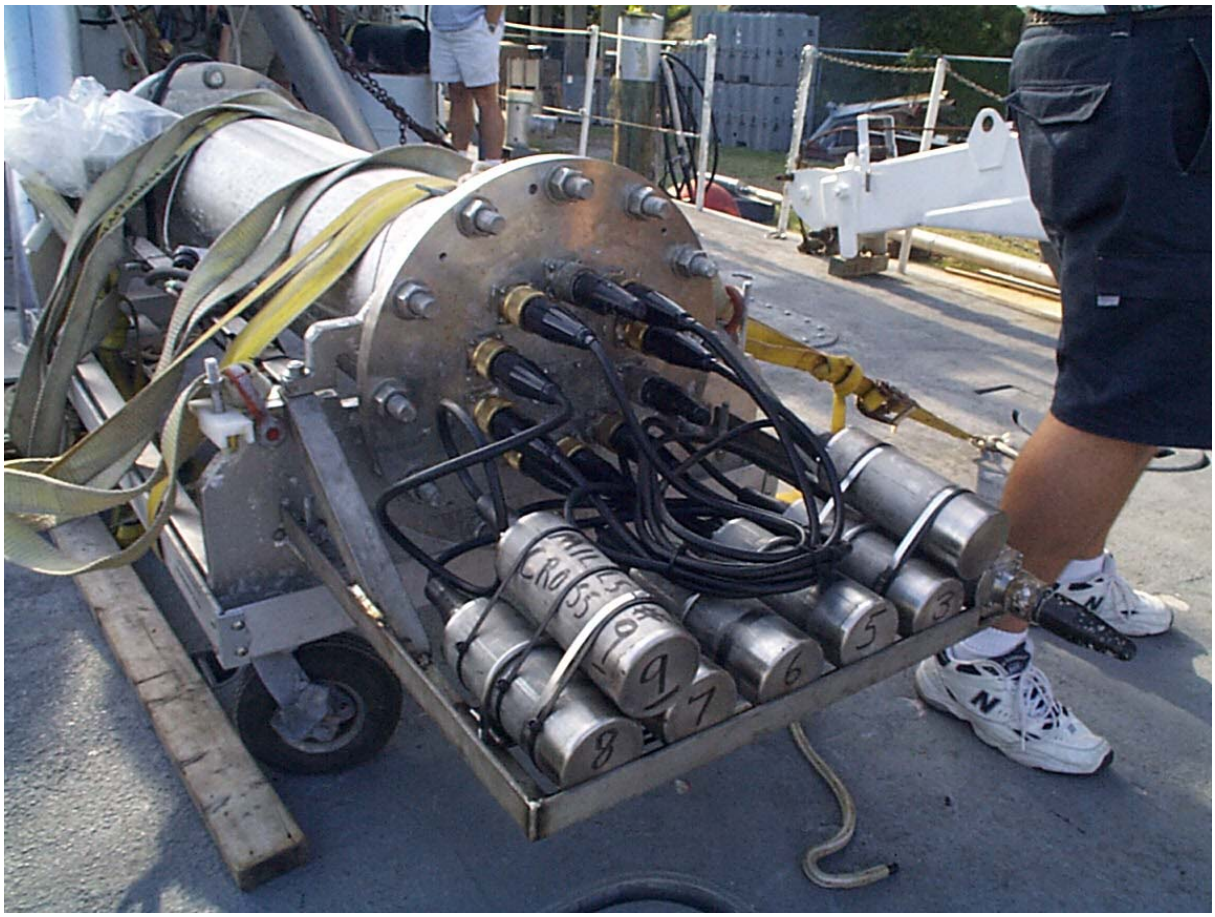
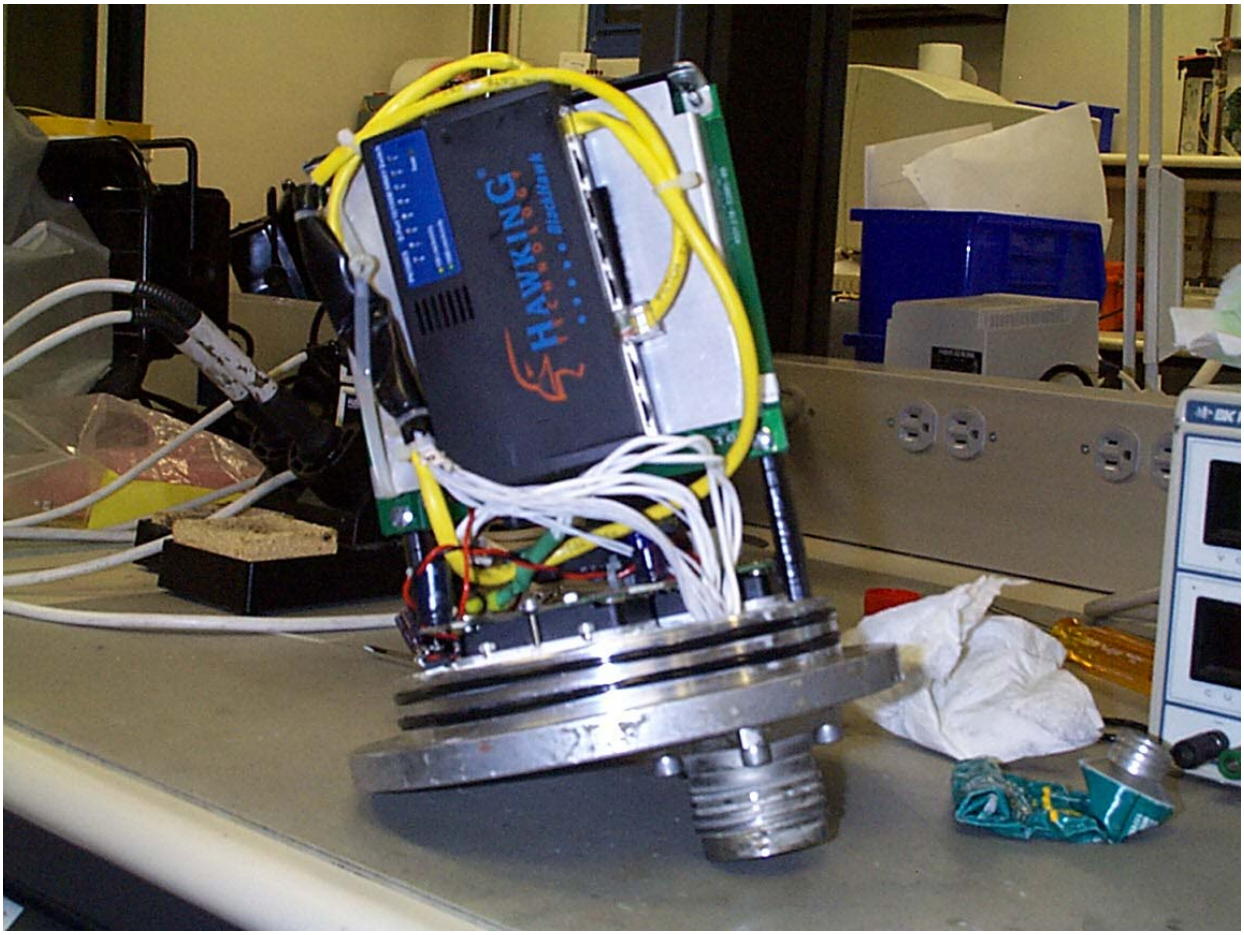
containing a microcomputer module capable of communicating using both Ethernet and serial (RS-232 and RS-422), and a separate board for Lonworks. Power is verified thru a loop back connection. The smart plugs allow the user to verify port operation before going to sea for deployment, and provide a straightforward means of testing during the at-sea equipment checkout just prior to deployment. The figure below shows the smart plugs installed on the Mux prior to deployment.



Other Mux improvements/additions were fiber optic splitters for fiber redundancy, backup serial control lines, new Ethernet switches and Lonworks transceivers for improved reliability, and reinforcement of all connections and mounts inside the pressure vessel.

The renovated Mux was extensively tested with the Mills-Cross in the lab and dockside at the SEATECH facility, and a few minor problems were resolved between the two units. Once deployed offshore, however, the Mills Cross and Mux would not communicate with each other or to shore. The HPSN control circuits, integral to the base design, were not changed during the refurbishment but appeared to be the problem, so the Mux was recovered and brought back to SFTF. In the interest of time, and the need to obtain measurements from the Mills Cross from shore, a small, single channel fiber optic telemetry unit was designed and built by SFTF, and deployed at the Mux site. The unit is shown below.



The Mills Cross was connected, and after a few minor problems, the units began communicating and have continued to operate successfully together. Meanwhile, the Mux has been disassembled and the design of a replacement of the HPSN control system with a more robust, serial based system is underway. Redeployment of the mux is scheduled for first quarter FY04.

RESULTS

The technical result is that we developed and underwater plug and play device capable of communicating using Ethernet, Lonworks, and serial (RS-232 and RS-422) from mutilple user ports, allowing users to verify port functionality prior to going to sea.

IMPACT/APPLICATIONS

Over the area of shallow water and very shallow water where the system is designed to operate the potential impact for science and systems applications is that multiplexer design provides for rapid experimentation startup at the sigificantly lower cost than conventional approaches. Since a wide variety of data transmission formats are supported over standardized ports it is relatively easy for real time data acquisition dependent experiments to be staged without high startup costs and lengthy lead times.

RELATED PROJECTS

The work is closely related to the development of a reliable bottom-mounted docking sub-system for autonomous underwater vehicles. The work now supports long term shallow water and very shallow water acoustic communications experimentation. It serves as the shore link for real time transmission by acoustic modem of images collected by a Bottom Object Survey System (BOSS). Finally, this multiplexer is the heart of existing and planned environmental measurement acquisition capability and is intended to provide the backbone for Navy applied research and Integrated Ocean Observing Systems data acquisition.